2. ALTERNATIVES

The IDFG Program has been in operation since 1995. For complete background on past planning, operation, monitoring, and evaluation, consult IDFG Program annual reports for 1998 and 1999 (IDFG 1999, 2000).

This chapter describes three action alternatives for accomplishing ongoing IDFG Program goals: a Proposed Action; a **Parr** Collection Alternative; and an Alternative Adult **Release** Site. The chapter also describes a No Action Alternative, which would not accomplish the IDFG Program goals.

The Proposed Action and the Parr Collection Alternative are similar, except that the Parr Collection Alternative proposes collecting broodstock at parr stage (approximately 8 months), while the Proposed Action would collect broodstock at **eyed-egg** stage. Rearing and release **protocols** would be much the same. The Alternative Adult Release Site is identical to the Proposed Action except that it proposes releasing sexually mature adults to Big Springs Creek in the Lemhi River drainage, rather than Bear Valley Creek.

All action alternatives may include hatchery spawning and eyed-egg **outplanting**, depending on **forecasted adult returns** and the availability of IDFG Program hatchery broodstock per **broodyear** and stream *(see Section 2.3: Hatchery Spawning and Eyed-Egg Outplanting).*

2.1. BACKGROUND

2.1.1. IDFG Program Goals/Assumptions/Objectives

IDFG Program managers believe that the low number of adult fish returning to IDFG Program-targeted streams ranks high as a contributing factor to the decline of local Salmon River spring/summer chinook populations. The estimated 20 adult fish returning annually to each target stream are not likely to produce sufficient offspring to either sustain current adult population numbers, or to retain **vital genetic diversity/variability** within the populations.

Therefore, the recovery goals of IDFG Program captive rearing activities focus on increasing the natural spawning populations within target streams.

IDFG Program managers assume that collecting **naturally spawned** broodstock, rearing them in the hatchery (captive rearing), and releasing them back to their streams of origin to mate with returning adults would increase spawning opportunities. This, in turn, would produce more offspring. Eventually, increased offspring would lead to (all other natural **escapement** factors being equal) an ongoing increase in the natural spawning population.

Three objectives are designed to accomplish the goal:

1. collect natural offspring from target populations for use as broodstock;
2. rear these offspring in-hatchery to sexual maturity; and

3. release the sexually mature offspring back to the streams from which they were collected.

2.1.2. IDFG Program Hypotheses

The research phase of the IDFG Program is designed to test corollary hypotheses:

- Hatchery rearing natural broodstock to adult stage would provide juvenile-to-adult survival benefits, increasing the pool of pre-spawn adults available to the respective **native populations**; and
- Collecting broodstock in the wild, rearing them in captivity, and then releasing them to spawn with their naturally rearing cohorts[6], would avoid or mitigate some genetic and adaptive impacts associated with conventional artificial production protocols and methods *(see Sections 4.2.1: Direct Impacts to Anadromous Salmonids, and 4.2.2: Indirect Impacts to Anadromous Salmonids).*

By reducing or eliminating these impacts, the production of offspring among hatchery reared and naturally reared cohorts in target streams is expected to increase. These offspring are expected to be better suited physically, **morphologically**, and **behaviorally** to compete in the wild at each life stage and reproduce. The ongoing capacity among future generations to reproduce is known as the productivity of the population. Production and productivity are the values that would be tested.

2.1.3. IDFG Program Uncertainties

There are two major uncertainties associated with captive rearing: 1) does hatchery rearing affect the number and viability of the gametes produced; and 2) do hatchery broodstock spawn successfully with their naturally reared cohort in the wild. The first question has been monitored and evaluated intensively since 1995, and the results are encouraging (IDFG 1999, 2000). Monitoring and evaluation emphasis is now on the second question.

2.2. PROPOSED ACTION

Under the Proposed Action, IDFG Program broodstock would be collected at eyed-egg stage from the three target streams. Following incubation and initial rearing at Eagle Fish Hatchery in Idaho, **smolts** would be transferred to the NMFS Manchester Marine Experimental Station for saltwater rearing (80 percent of the sample), or remain at Eagle Fish Hatchery for freshwater rearing (20 percent of the sample). As fish mature, they would be sorted for sexual maturity, and released back to their respective streams of origin. All activities would be monitored and evaluated.

[6] *Cohort* refers to fish of the same population, produced during the same broodyear. Specifically, in the IDFG Program case, there are fish of a population collected for hatchery rearing (the sample), and fish of the same population left to rear naturally; the sample fish and the naturally rearing fish of the same broodyear are cohorts of one another.

Broodstock would be spawned in the hatchery to conduct gamete evaluations or to conserve populations if forecasted natural adult returns are zero. *(See Section 2.3: Hatchery Spawning and Eyed-Egg Outplanting).* **Eyed eggs** from these fish would be outplanted to incubation **hatchboxes** at selected sites within the project area. These activities would be monitored and evaluated.

2.2.1. Eyed-Egg Collection

In the last several years, natural spawning populations have produced fewer than 20 **redds** in each of the target streams. Natural spawning populations are expected to produce similar or diminishing redd numbers for the next several years (IDFG 2000).

Objectives: IDFG personnel would collect eyed eggs from the project areas. No more than six redds would be sampled in each stream. Fifty eyed eggs would be collected from each of the six redds per stream. Assuming a hatchery egg-to-adult survival rate of approximately 0.8, eyed-egg collection should yield approximately 240 adult broodstock per target stream. This number of broodstock could encompass 95 percent of the genetic diversity/variability of each population (Stanley Basin Sockeye Technical Oversight Committee, personal communication).

Protocols: Prior to spawning, personnel would survey redds weekly, changing to daily surveys during spawning. Individual redds would be located and accurately marked in study streams. The last day of egg deposition for each redd would be recorded to monitor egg development. Personnel would place temperature monitors in each stream at various locations, providing data relating stream temperature to eyed-egg development.

Hydraulic sampling procedures[7] would begin below egg pockets in the tail spill of the redd. Crews work progressively upstream until they encounter eggs. The work probe is designed with an air intake that creates a venturi effect, introducing both water and air into the redd. The discharge is relatively gentle, lifting eggs and small substrate up into the water column. Once the eggs are safely dislodged, they are recovered in the collection net.

The collected eggs are transported to the Eagle Fish Hatchery according to IHOT (1995) protocols.

Lemhi River redds are typically distributed between Leadore and Cottam Lane, a distance of approximately 11.2 kilometers (km) (7 miles). Spawning is usually initiated in early August, and continues throughout the month.

Redd surveys would begin in the first week of August. There is road access along both sides of the stream over the entire spawning area. All access to the stream is across private property. Regional personnel would coordinate access with private landowners.

[7] Personnel would carry equipment on backpack frames to each site, composed of three major elements: a hydraulic pump with 3.75 centimeter (1-1/2 inch) discharge and intake ports; intake and discharge hoses (3.75-centimeter diameter) fitted with cam-lock fittings; and catch baskets/nets, egg recovery, and egg transportation equipment.

Two or three sample days would be required to collect the eggs. Travel time from the Lemhi River to Eagle Fish Hatchery is about 6.5 hours.

West Fork Yankee Fork Salmon River redds are typically distributed from the mouth of the West Fork Yankee Fork upstream approximately 12 km (10 miles). Most spawning occurs from late July through early August. Redd surveys would begin in the third week of July.

Limited road access is available only near the mouth of the stream. The upper 9.6 km (8 miles) of the redd distribution is accessed via United States Forest Service (USFS)-maintained trail on USFS property. Because of trail-only access, two or three days would be required to collect the eggs. Travel time to Eagle Fish Hatchery is approximately 4 hours from the West Fork Yankee Fork Salmon River.

East Fork Salmon River redds may be distributed upstream of the hatchery satellite facility, a distance of approximately 15.6 km (13 miles). Spawning occurs from mid-August through mid-September.

Redd surveys would begin in the first week of August. There is road access along the entire spawning area. Access to the stream is across private and USFS property. Regional personnel would coordinate access with private landowners. Two or three sample days would be required to collect eggs. Transit of eggs from the East Fork Salmon River to Eagle Fish Hatchery takes about 6 hours.

2.2.2. Rearing Protocols

Eyed eggs would be transported to Eagle Fish Hatchery for incubation. Following **swim up**, hatchlings would be transferred to indoor rearing ponds, and reared on a growth program.

At age 1+, 80 percent of juveniles would be transported to NMFS Manchester Marine Experimental Station for saltwater rearing. The remaining 20 percent would remain at Eagle Fish Hatchery for freshwater rearing. Freshwater and saltwater rearing densities would not exceed 0.22 kilograms (kg)/0.03 cubic meters (0.5 pound/cubic foot).

Natural water temperature regimes would be maintained year-round, and natural photoperiod would be maintained. Strict **quarantine** practices would be maintained at all facilities. Fish would be monitored, treated, and medicated for disease as needed.

As IDFG Program data and regional research indicates, rearing protocols and physical facilities would be adapted for more natural rearing conditions (Maynard et al 1997).

2.2.3. Adult Outplant Design and Protocols

Outplant protocols are determined each year by the IDFG Program Technical Oversight Committee. The size of the release is based on forecasts of natural adult returns to each target stream and the availability of hatchery-reared mature adults.

Once adult hatchery broodstock were selected for release, IDFG or cooperating personnel would transport them to release locations. Release generally would occur

throughout the month of August, depending on adult return timing to each target stream. The vehicles used are equipped to provide the appropriate conditions for safe transfers.

Hatchery broodstock would be released into enclosures or other barriers, as appropriate, to prevent them from straying out of spawning areas. These structures would be carefully monitored several times per day. The West Fork Yankee Fork Salmon River and East Fork Salmon River enclosures would be constructed on one side of the stream to provide easy passage around them. Because of the relatively small stream channel, partial channel enclosures at the Bear Valley Creek release site would not be suitable. Broodstock would be enclosed between a weir blocking downstream straying and a natural, partial barrier upstream. This structure would include a trap to allow **wild fish** (natural chinook salmon and bull trout) to pass the structure. Migrating chinook salmon, steelhead, and bull trout (if any individuals are present) would be collected and passed unharmed.

Release sites are selected for the presence of pools or slow-water resting areas, escape areas with cover, and suitable spawning substrate. Fish would be released into eddies and along stream margins to minimize initial energy expenditure.

The proposed release site for ***Lemhi River*** drainage broodstock is a two-mile section of Bear Valley Creek, a tributary to Hayden Creek (in the Lemhi drainage). The IDFG Program proposes no releases of sexually mature broodstock into Bear Valley Creek in Fiscal Year 2000, since the IDFG forecasts fewer than two returning natural adults. Mature hatchery-reared adults would be spawned in-hatchery *(see Section 2.3: Hatchery Spawning and Eyed-Egg Outplanting).* Eyed eggs would be outplanted.

No mature adults would be released into the ***West Fork Yankee Fork Salmon River*** in Fiscal Year 2000 due to forecasted low adult returns (less than 2 fish). The program has fewer than 10 mature hatchery-reared West Fork Yankee Fork adults, which would be spawned in-hatchery. Eyed eggs would be outplanted. Future West Fork Yankee Fork hatchery brood would be released to the West Fork Yankee Fork at a site 1.2 km (.75 miles) upstream of the confluence of the West Fork Yankee Fork and the Yankee Fork Salmon River.

No mature adults would be released into the mainstem ***East Fork Salmon River*** in Fiscal Year 2000 due to forecasted low adult returns. Mature hatchery-reared adults would be spawned in-hatchery. Eyed eggs would be outplanted.

2.2.4. Monitoring and Evaluation of Adult Outplants

IDFG Program managers monitor and evaluate IDFG Program protocols and procedures by reference to the values of "production" and "productivity." Production refers to the numbers of offspring produced by each target population in a given year. Productivity refers to the ongoing capacity of a population to produce offspring.

It can be difficult to measure these two values directly, since the natural populations do not stay put for counting exercises. Therefore, the two value measures are measured indirectly, by evaluating certain population responses that can be more reliably tracked. For instance, tracking how a population is developing at critical life stages indicates

whether the population will likely continue to reproduce over generations (productivity). Such indicators would be such things as the age structure of the maturing captive population, the spawning ratio of supplemented and unsupplemented adults, parr distribution and growth, etc. If these indicators are good, the population would seem to be developing well, and likely to be productive.

A list of these response variables evaluated by the IDFG Program is given below.

Production Response Variables

- number of redds constructed
- mid-summer parr production from spawners
- fall and spring emigrant (**pre-smolt** and **smolt**) production
- total smolt production
- adult escapement resulting from adult outplants

Productivity Response Variables

- survival (egg-to-parr, parr-to-smolt, smolt-to-adult or redd counts)
- **fecundity**
- age structure of the maturing captive population
- spawning ratio (supplemented and unsupplemented adults)
- parr distribution and growth
- emigration timing

(For more, see the Bowles and Leitzinger [1991] research plan for monitoring and evaluating artificial rearing programs.)

2.3. HATCHERY SPAWNING AND EYED-EGG OUTPLANTING

Each year, IDFG Program personnel forecast the number of adult spring/summer chinook salmon expected to return to each target stream. Based on these forecasts and the recommendations of the Technical Oversight Team (TOC), they then schedule adult hatchery releases. If few adults are forecasted to return to a target stream, hatchery adult releases may be reduced to zero. This strategy creates a "safety-net," so that hatchery broodstock genetic material is not lost if no natural mates return.

In this case, broodstock would be spawned in the hatchery. Some of the spawn would be used to conduct gamete evaluations; some would be cryopreserved for eventual spawn crossing to ensure the continued existence of a spawning cohort. Most would be immediately spawned-crossed. Offspring of these spawn crosses would be outplanted at the eyed-egg stage to target streams. Once outplanted, the offspring incubate in hatchboxes, release volitionally into the wild, and rear naturally.

Spawning: For hatchery spawning, the genetic make-up of individual fish would be identified. A dissimilarity **spawning matrix** would be used to maintain genetic variability. Using individual genetic identities, the matrix would prioritize specific crosses by **genotype** and **haplotype**. Hatchery spawning also includes protocols for

bridged-generation breeding, e.g., 3-year olds mated with 4-year olds, 5-year-olds mated with 4-year-olds, etc.

Transporting: Eyed-eggs are transferred from the Eagle Fish Hatchery to field outplanting sites in perforated shipping tubes. Tubes are wrapped in water-saturated cheesecloth and packed in small, insulated coolers. Ice chips are added to provide proper temperature maintenance. Prior to loading hatchery incubators, eggs are disinfected in 100 parts per million iodophore for 30 minutes. Eggs are transported in standard pickup trucks.

Incubation: A single incubation system, or a combination of instream and streamside incubation systems, may be employed at any IDFG Program site, depending on the recommendation of the TOC.

Whitlock-Vibert streamside hatchboxes are small baffled boxes nested in a 78-centimeter (cm) x 78-cm x 1.68-m (2.6-foot x 2.6-foot x 5.6-foot) commercially available, top-loading freezer unit with its door removed. Units are located next to a water source (usually a spring). Water from the spring is gravity fed via polyvinyl-chloride pipe into the larger unit and over the eggs, then routed back to the spring channel.

Each freezer has a capacity of approximately 100,000 eggs. The number of eggs outplanted per year has been approximately 10,000 or less per site (IDFG 1999, 2000), suggesting that one freezer per site would accommodate eyed-egg outplanting. Following fry swim up, juveniles volitionally emigrate via a standing overflow pipe into the spring channel, and eventually into the stream reach. Very little site preparation is required. The Whitlock-Vibert streamside system—if used—would be used at sites with road access, since they require the heavy freezer unit.

Jordan-Scotty hatchboxes would be carried into the remote sites. Instream Jordan-Scotty hatchboxes are approximately 50 cm x 5 cm (20 inches x 20 inches). They are anchored by rebar to a depth of 360 cm to 1,080 cm (1 to 3 feet) in box-sized depressions. These depressions are excavated by IDFG Program personnel in suitable gravel substrate in the midline of the streambed. Eggs are housed in individual spaces on a rack, and there are several racks per box. Streamflow through the hatchboxes would be a minimum of 1 cubic foot per second (cfs) to 3 cfs.

Outplanting Locations: Eyed-egg production from ***Lemhi River*** spawn crosses would be transferred to a site adjacent to Hayden Creek, a tributary to the Lemhi River. The incubation site is located approximately 7 km (4.3 miles) upstream of the confluence of Hayden Creek and the Lemhi River, near the Hayden Creek Hatchery site.

Eyed-egg production from ***West Fork Yankee Fork*** spawn crosses would be transferred to a site located approximately 3 km (1.9 miles) upstream of its confluence with the mainstem Yankee Fork.

Egg production from ***East Fork Salmon River*** spawn crosses would be transferred to a site approximately 31 km (19 miles) upstream of the confluence of the East Fork Salmon River and the mainstem Salmon River.

Outplanting locations could change in the future, based on results achieved at the proposed locations.

2.4. PARR COLLECTION ALTERNATIVE

As an alternative to collecting Salmon River spring/summer chinook salmon broodstock at the eyed-egg stage, the IDFG Program proposes to collect parr. NMFS Section 10 Permit FR 43230 permits the IDFG Program to collect a maximum of 200 parr for broodstock per target stream, or a maximum of 25 percent of the parr population per target stream.

Under this alternative, parr would be collected in the fall over a broad range of each stream using rotary screw traps (EG Solutions, Corvallis, Oregon) and beach seines[8]. When collecting parr, seine crews work cooperatively with snorkel crews. Following location of parr, seine crew personnel would position the seine downstream of the targeted fish. Non-target species of concern (steelhead and bull trout) captured during efforts to collect juvenile chinook salmon would be released unharmed.

Collected parr would be temporarily held in streamside live boxes. Within a few hours of collection, parr would be transported to Sawtooth Fish Hatchery for initial holding. All rearing and release measures for this alternative are identical to the Proposed Alternative.

2.5. ALTERNATIVE ADULT RELEASE SITE (BIG SPRINGS CREEK)

As an alternative to releasing Lemhi River hatchery adults to Bear Valley Creek, the IDFG Program proposes releasing them at Big Springs Creek. In the past, seasonal water withdrawals from Bear Valley Creek have dewatered sections of the stream, which has led to a wider concern for water quantity at this site. While these withdrawals have been halted, IDFG Program managers believe that Big Springs Creek provides more reliable water quantity.

A weir would segregate sample fish in the upper section of the stream. A trap box situated midstream in the weir would be checked daily, and resident and anadromous fish passed upstream and downstream.

All other IDFG Program measures and protocols for this alternative would be identical to the Proposed Action.

2.6. NO ACTION ALTERNATIVE

Under the No Action Alternative, BPA would not fund ongoing program activities. Activities could proceed under a different funding source. However, no other funding sources have been identified.

[8] Rotary screw traps are passive capture devices generally positioned in the midline of the streambed. Streamflow rotates the trap drum, which in turn funnels fish safely to a live well for temporary holding.

2.7. COMPARATIVE RESPONSE OF ALTERNATIVES TO DECISION FACTORS

The following table compares the responses of the alternatives to required decision factors *(see also Section 1.3: Purposes (Decision Factors))*.

Table 1: Responses of Alternatives to Decision Factors

Decision Factor	Proposed Action	Parr Collection Alternative	Alternative Adult Release Site (Big Springs Creek)	No Action
Technical Performance The alternative : 1. is consistent with the Council's 1987 Fish and Wildlife IDFG Program, and 1995 IDFG Program Amendments; 2. complements activities of fish and wildlife agencies and appropriate tribes; 3. is consistent with the legal rights of the appropriate tribes in the region; 4. develops and transfers information and technology.	1. Mitigates in a manner consistent with the Council's Fish and Wildlife Plan, and NMFS' Draft Recovery Plan for Snake River Salmon. Consistent with Council's Measure 7.3B for anadromous fish, and consistent with Task 4.1b of the Recovery Plan, as well as with the Biological Opinion for hatchery operations; 2. Complements other activities *(see 1.5: Relationship to Other Projects)*; 3. Is Consistent with legal rights of tribes; 4. Develops and transfers technology.	Same as the Proposed Action for all decision factors.	Same as the Proposed Action for all decision factors.	1. Would not mitigate for anadromous fish losses; 2. Bears no relationship with other recovery activities; 3. Neither consistent nor inconsistent. (BPA has no affirmative legal responsibility to the tribes to fund any particular recovery project); 4. Would not develop or transfer information and technology.

Table 1 continued

Decision Factor	Proposed Action	Parr Collection Alternative	Alternative Adult Release Site (Big Springs Creek)	No Action
Economic Performance The alternative is administratively efficient and cost-effective.	Meets the biological objectives with reasonable cost. Proposed Action may increase costs over Parr Collection Alternative, reflecting increased cost of incubation and rearing from eyed eggs.	Meets the biological objectives with reasonable cost. Cost associated with rearing captive broodstock from eyed egg would be absent. However, this could be offset by costs associated with rearing broodstock from parr (e.g., cost of enhanced disease control, etc.).	Same as the Proposed Action for all decision factors.	No cost or administrative impacts.
Environmental Performance The alternative: 1. avoids or minimizes adverse environmental impacts; 2. has the best potential to achieve biological objectives, including: • supplementation of wild spawning population; • preservation of unique genetic heritage of target population.	1. Proposed Action should have minimal impacts on human and/or environmental resources; 2. Proposed Action, if successful, would accomplish the biological objectives.	Alternative minimizes adverse environmental impacts and accomplishes biological objectives. However, assumed lower juvenile-to-adult survival ratio for hatchery parr may reduce IDFG Program effectiveness relative to broodstock collected as eyed eggs.	Same as the Proposed Action.	1. Has no impact on environmental resources; 2. By not supplementing natural populations, no action would not slow or stop trend toward extirpation.